



MAINTENANCE INSTRUCTION

TRACTION MOTOR ARMATURE BEARING ASSEMBLIES

INTRODUCTION

Traction motor armature bearings have been carefully designed to withstand the rigorous conditions encountered in normal locomotive operation. They are manufactured from the finest materials available and to exacting tolerances necessary for this vital area in a motor.

In consideration of their importance, armature bearings and their associated components should be given the most careful handling and thorough inspection possible to qualify them for return to service. Certainly their condition should be such that no doubt should exist as to their capabilities of successful performance until the next traction motor overhaul period. All questions of doubt should therefore be settled on the safe side.

It should also be remembered that in addition to the foregoing considerations, these bearings require proper lubrication, cleanliness, and careful handling and installation.

NOTE: Condemning limit dimensions are shown on the figure references either as maximum or minimum allowance along with the manufacturing tolerance for the same dimension. The condemning limits are given only where wear or distortion is permitted.

This bulletin is prepared in two parts, the first being concerned with bearing components such as covers, housings and caps. The second part is devoted specifically to the roller bearing assembly such as cages, races and rollers.

BEARING ASSEMBLY COMPONENTS

GENERAL

D77B motors built since January 1, 1971, are equipped with an improved P.E. seal arrangement. The assembly of the bearing component parts can be seen in Section 3 of this Maintenance Instruction. Both the previous and current model bearing component parts as well as the "E" model parts are covered in this Maintenance Instruction. Therefore, some P.E. component parts may show three different types.

CLEANING

Bearing assembly components should be thoroughly cleaned prior to inspection to remove all dirt, oil, grease and other foreign materials. Stoddards solvent (ASTM D474-40) or similar noncorrosive solvent having a flash point of 115° F. or higher may be used.

A clean brush or lintless cloth may be used to facilitate cleaning. Gasket surfaces should be given special attention to remove all traces of remaining gasket material.

COMMUTATOR END BEARING COVER

1. Inspect bearing and gasket face surfaces for wear or roughness.
2. Inspect lubricating tube 1/4" standard pipe tapped hole, if used, and retap if necessary.
3. Inspect the depth of the grease pocket. Minimum depth over the entire area shall not be less than 1-3/16" when measured from the gasket surface.

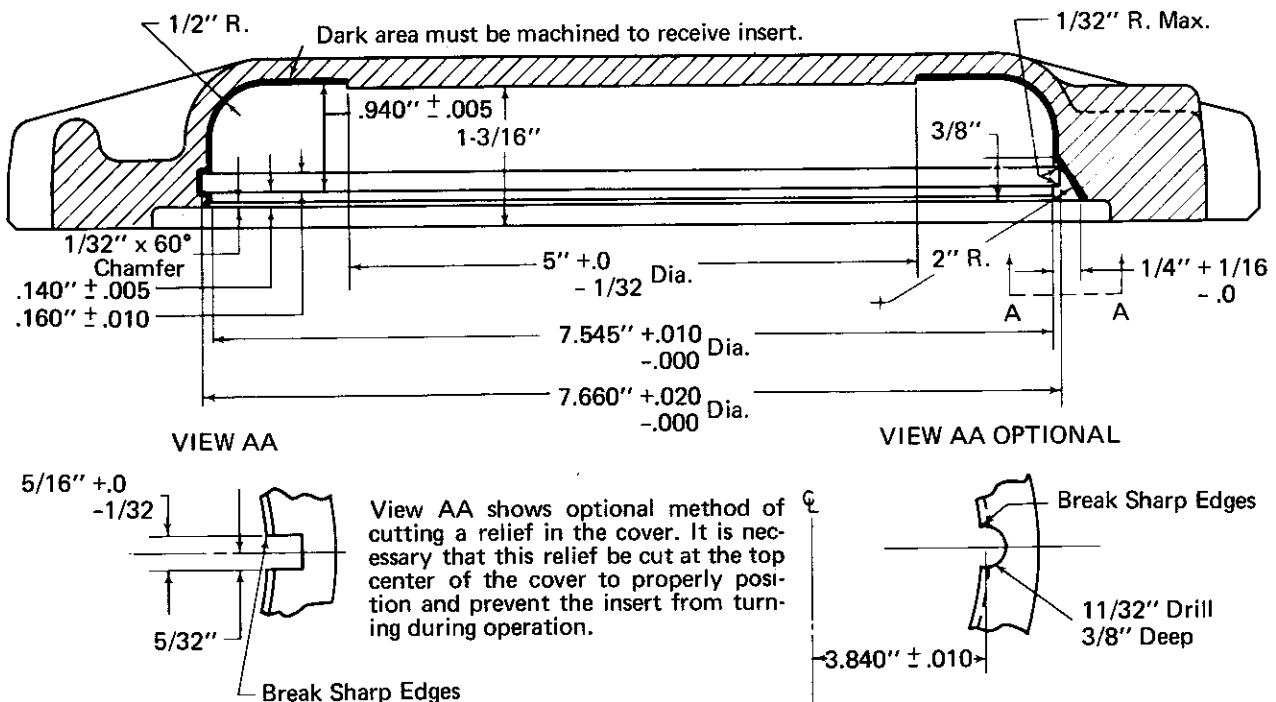
4. Commutator covers not equipped with the nylon antichurn insert 8248804 may be machined to receive the insert as shown in Fig. 1.
5. Bearing covers with the nylon antichurn insert should have the insert removed, the cover thoroughly cleaned and a new insert installed.

COMMUTATOR END BEARING HOUSING

1. Check inside diameter of housing, Fig. 2. Condemning limit is 8.4644". When bore diameter is beyond acceptable limits and all other dimensions are within tolerance, the bore may be restored to acceptable limits by nickel plating and remachining to drawing tolerance.
2. Check housing to frame fit. Condemning limit is 12.124".
3. Check width of bearing bore. It should be within 1.435" to 1.441".
4. Check the threads of the eight 3/4"-10 tapped mounting holes. Retap if necessary.
5. After inspecting the housing, paint back side with red insulating enamel 8061130. Keep enamel off machined faces, fits, and bearing bore.

COMMUTATOR END BEARING CAP

1. Check the inner labyrinth, Fig. 3, for wear and broken lands. The condemning limit of this diameter is 4.549".
2. Check the inner labyrinth outside diameter for wear. The condemning limit for this diameter is 5.242".
3. Check the outer labyrinth for wear and broken lands. The condemning limit of this diameter is 6.300".



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Fig. 1 - C.E. Bearing Cover Modification

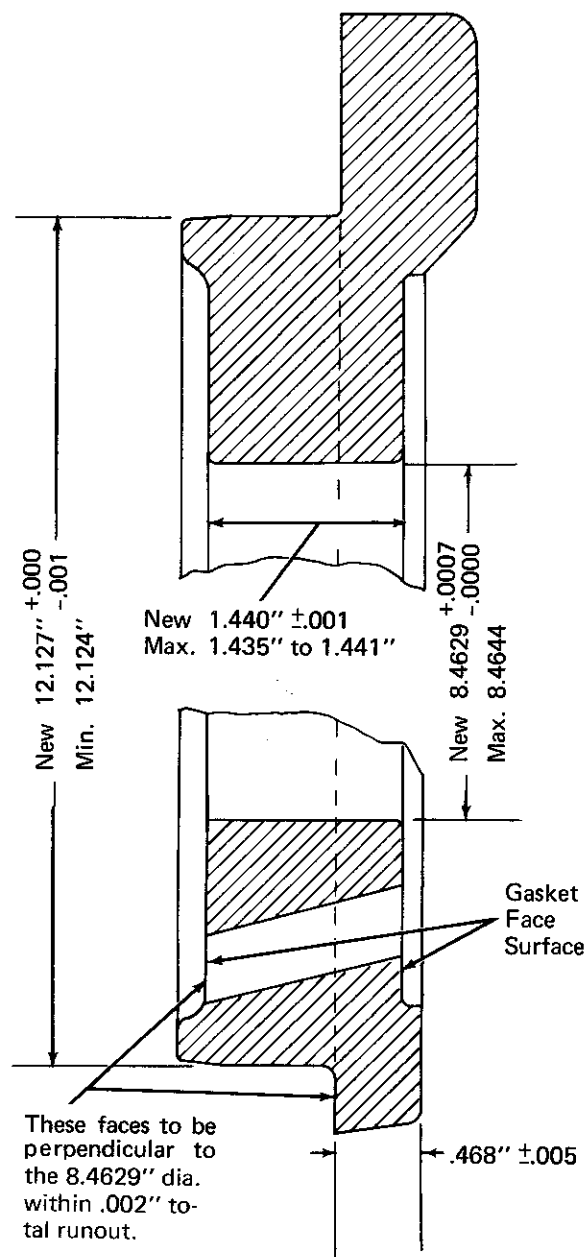


Fig. 2 - C.E. bearing Housing

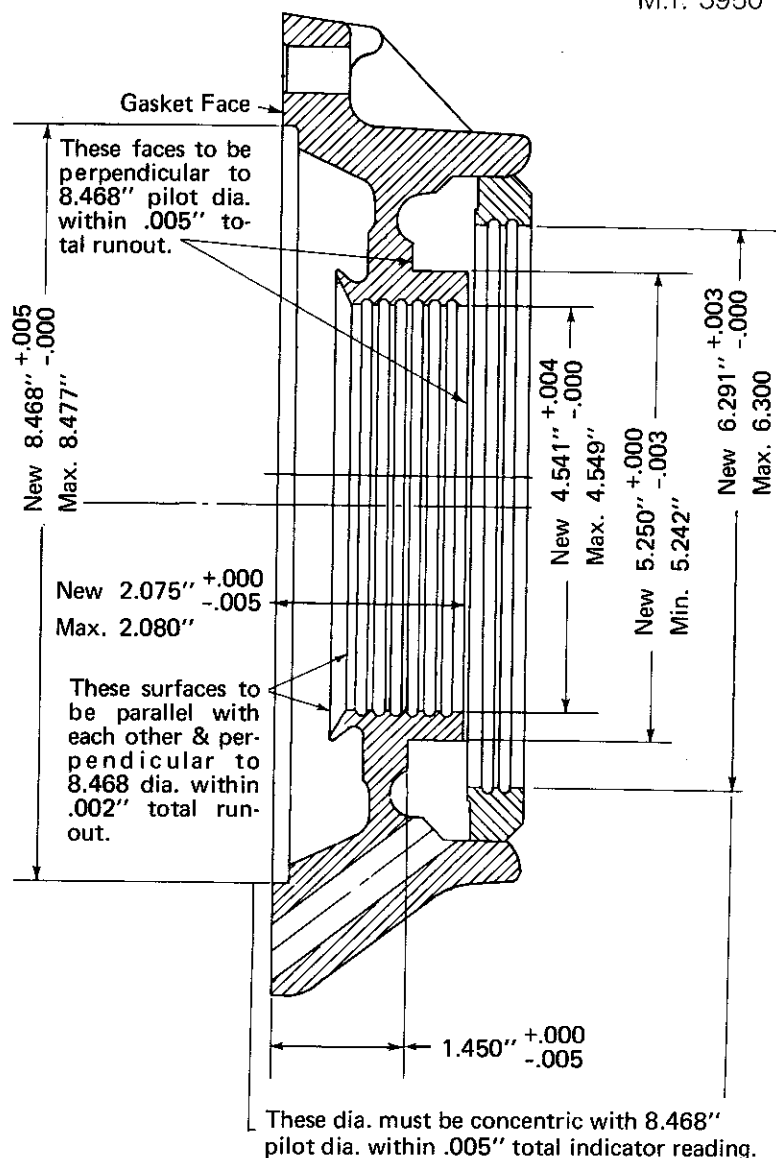


Fig. 3 - C.E. Bearing Cap

4. Check the pilot bore diameter of the cap into which the outer race of the bearing fits. Condemning limit is 8.477".
5. Check the depth of the pilot bore diameter. It should be $.187 \pm .002$ ".
6. The gasket face surfaces should be parallel with each other and perpendicular to the 8.468" diameter within .002" total runout.
7. The diameters in Steps 1, 2 and 3 must be concentric with 8.468" pilot diameter bore within .005" total indicator reading.
8. Check the 2.075" dimension from the gasket face surface to the back face of the inner labyrinth. Condemning limit is 2.080".
9. Check the threads of the six 5/8"-11 NC bolt holes and retap if necessary. Paint outside of cap with red enamel 8061130.

COMMUTATOR END OIL THROWER

1. Check the oil thrower bore diameter, Fig. 4. It should be within 3.953" to 3.9545".
2. Check the bore faces for perpendicularity to the 3.953" bore. Runout should not exceed .001" maximum.
3. Check the dimension (thickness) between faces. It should be within .543" to .546".
4. Inspect flange of oil thrower for damage; if broken, do not reuse the oil thrower. Small nicks or imperfections on the 1/32" radius are permissible.

COMMUTATOR END BEARING RETAINER

The commutator end bearing retainer has only one wear limit. This is on the .111" dimension, Fig. 5. The condemning limit is .108".

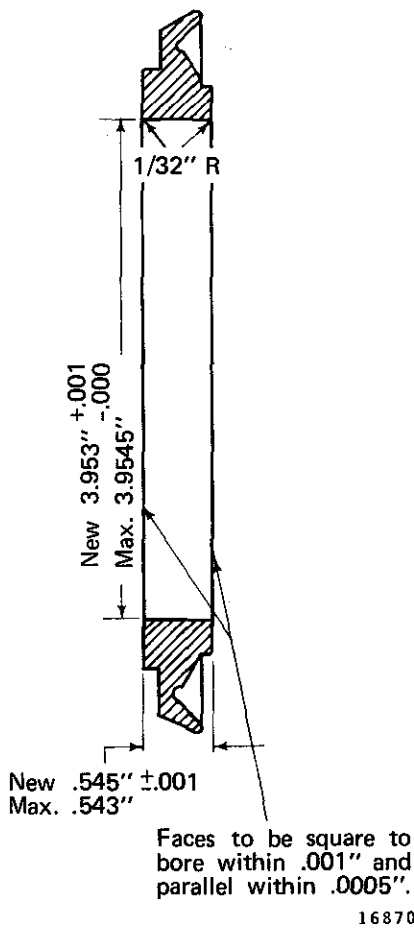


Fig. 4 – C.E. Oil Thrower

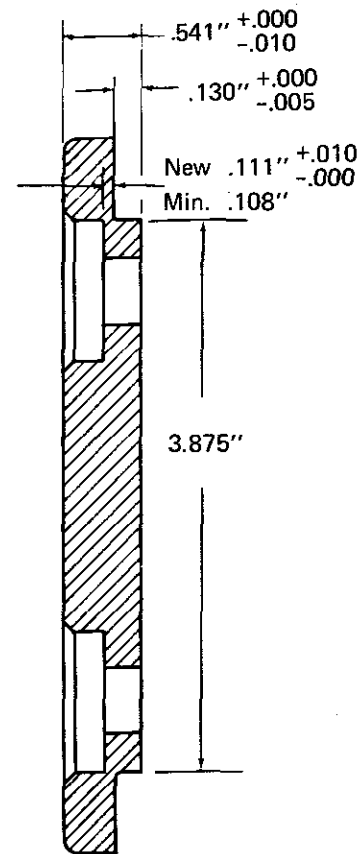


Fig. 5 – C.E. Bearing Retainer

COMMUTATOR END COLLAR & SPACER

The collar and spacer are individual parts shrunk on the shaft which are not removed during bearing disassembly unless worn or damaged.

1. Check outside diameter. Condemning limit is 6.243".

2. Oil labyrinth diameter condemning limit is 5.300".
3. If collar has to be removed and is still usable, the condemning limit for the bore diameter is 3.9685".
4. A spacer once removed should not be reused.

PINION END BEARING CAP

1. Check the inner labyrinth (small diameter) lands for wear and broken lands, see Fig. 6. This diameter should be within 6.161" to 6.176" with .005" maximum taper acceptable. On "E" bearing caps the diameter should be between 7.666" to 7.676" with .005" maximum taper acceptable.

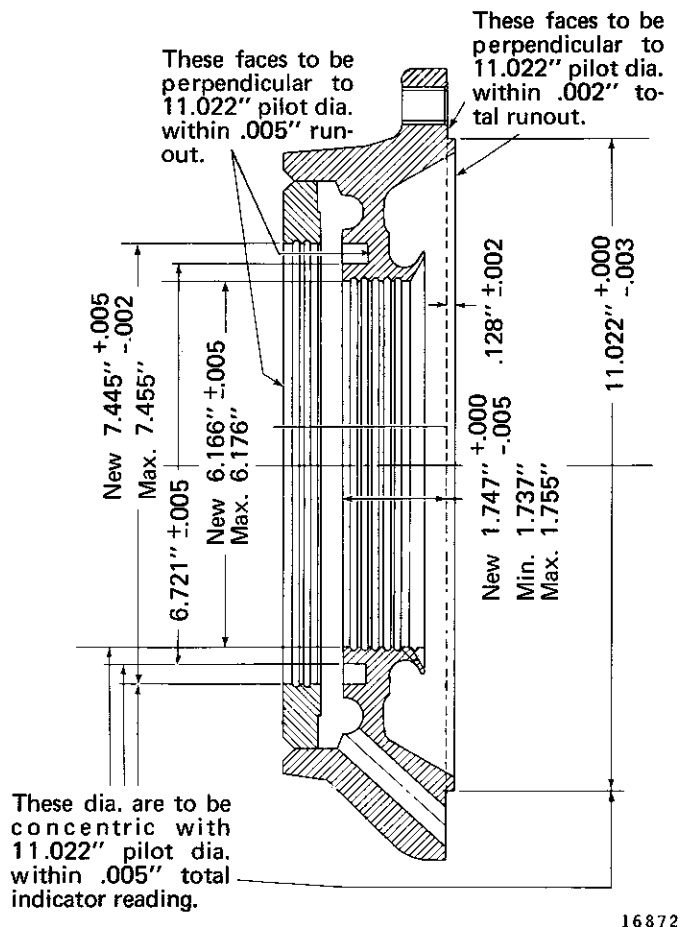


Fig. 6 — P.E. Bearing Cap

2. Check the outer labyrinth (large diameter) lands and counterbore for wear. This diameter should be within 7.443" to 7.455". On "E" bearing caps the diameter should be within 8.955" to 8.970".

NOTE: Small nicks or imperfections on ridge are permissible providing they are "cleaned up" with a file or abrasive cloth. Remove protrusions only.

3. Check the inner labyrinth outside diameter for wear. This diameter should be within 6.166" to 6.176". On "E" bearing caps the diameter should be within 7.666" to 7.670".
4. Check the bearing cap pilot diameter. This diameter should be within 11.019" to 11.022". On "E" caps it should be within 12.594" to 12.597".
5. Check the dimension between the pilot face surface and the gasket face surface. It should be within .126" to .130".

6. The gasket face surface and the pilot diameter face surface should be parallel with each other and perpendicular to the pilot diameter within .002" total runout.
7. Concentricity of the inside and outside diameters of the inner labyrinth bore and inside diameter of the outer labyrinth bore to pilot diameter must not exceed .008" total indicator reading.
8. Check the 1.747" dimension from the gasket face surface to the back faces of the inner labyrinth section. It should be within 1.737" to 1.755". These faces must be parallel to each other within .010" total indicator reading. If the surfaces are not within tolerance, the cap should be replaced.
9. Check the eight 5/8"-11 NC tapped holes and retap if necessary.
10. Paint the outside of the bearing cap with red enamel 8061130.

PINION END BEARING COVER

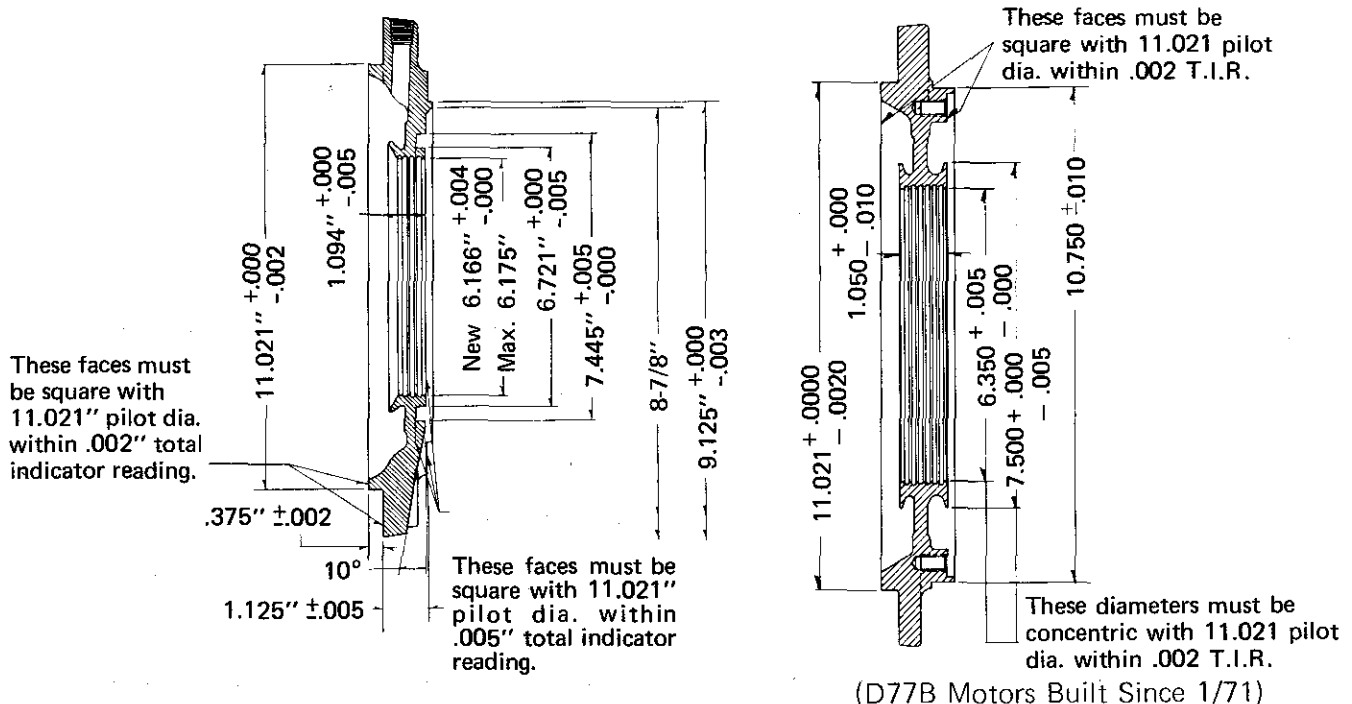
1. Check the labyrinth lands for wear and broken lands, Figs. 7 and 8. Wear caused by rubbing or broken lands is not permissible.
2. Labyrinth bore diameter condemning limit is 6.175". On "E" model covers, Fig. 8, the condemning limit is 7.674".
3. Check the counterbore inside and outside diameters. No wear or rubbing is permissible.

NOTE: The inside and outside of counterbore diameter must conform to the dimensions in Figs. 7 and 8 to avoid possible interference with mating parts.

4. All other dimensions as shown in Figs. 7 and 8 should not vary more than .002" for covers that have been in service.

PINION END GREASE SEAL

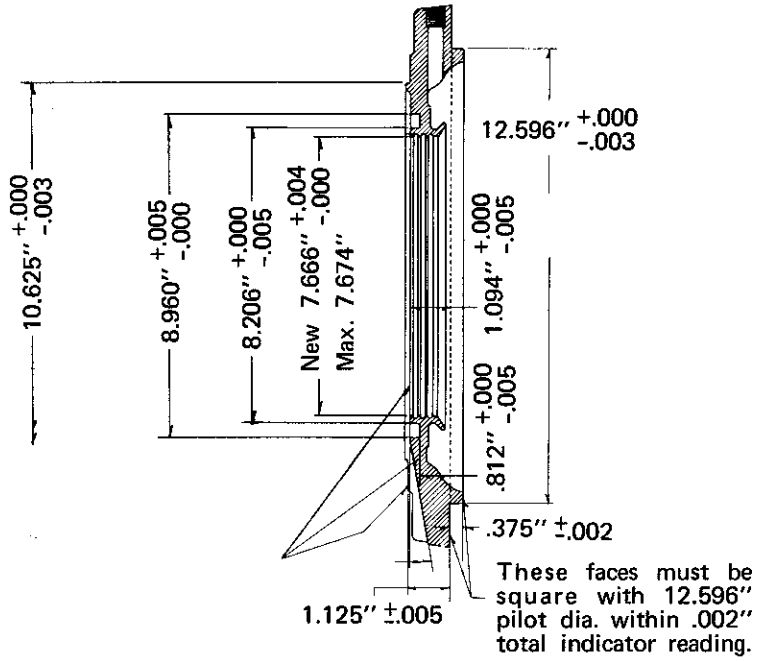
1. Check the labyrinth inside and outside diameter for rubbing or wear. When rubbing is found, the seal should not be reused.
2. Distortion due to warping is allowed up to 1/64" providing the part will bolt down flat.



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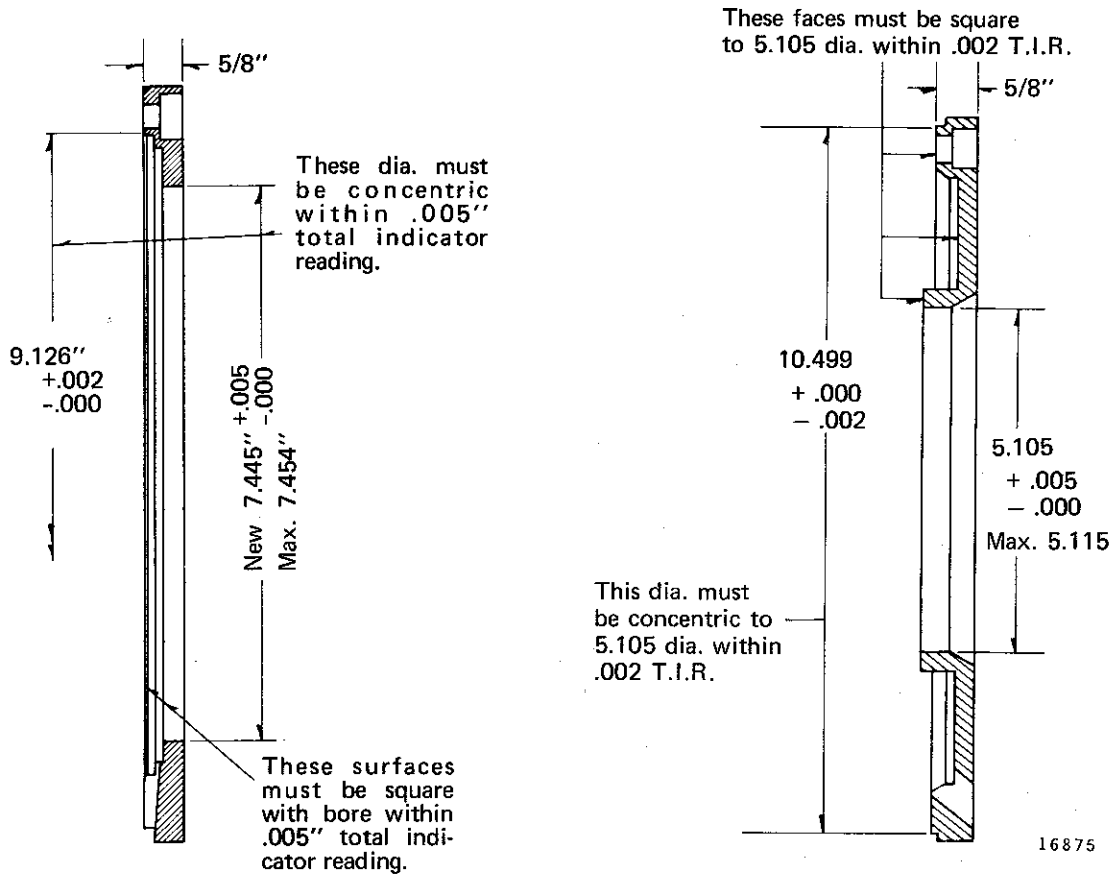
Fig. 7 — P.E. Bearing Cover

3. All other dimensions should not vary more than .002" for seals that have been in service, see Figs. 9 and 10.



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Fig. 8 — P.E. Bearing Cover "E" Model

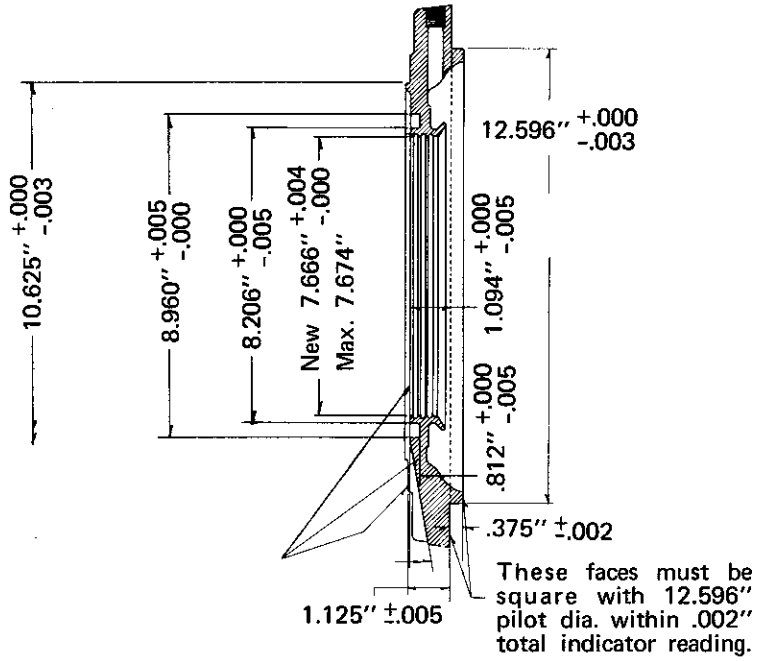


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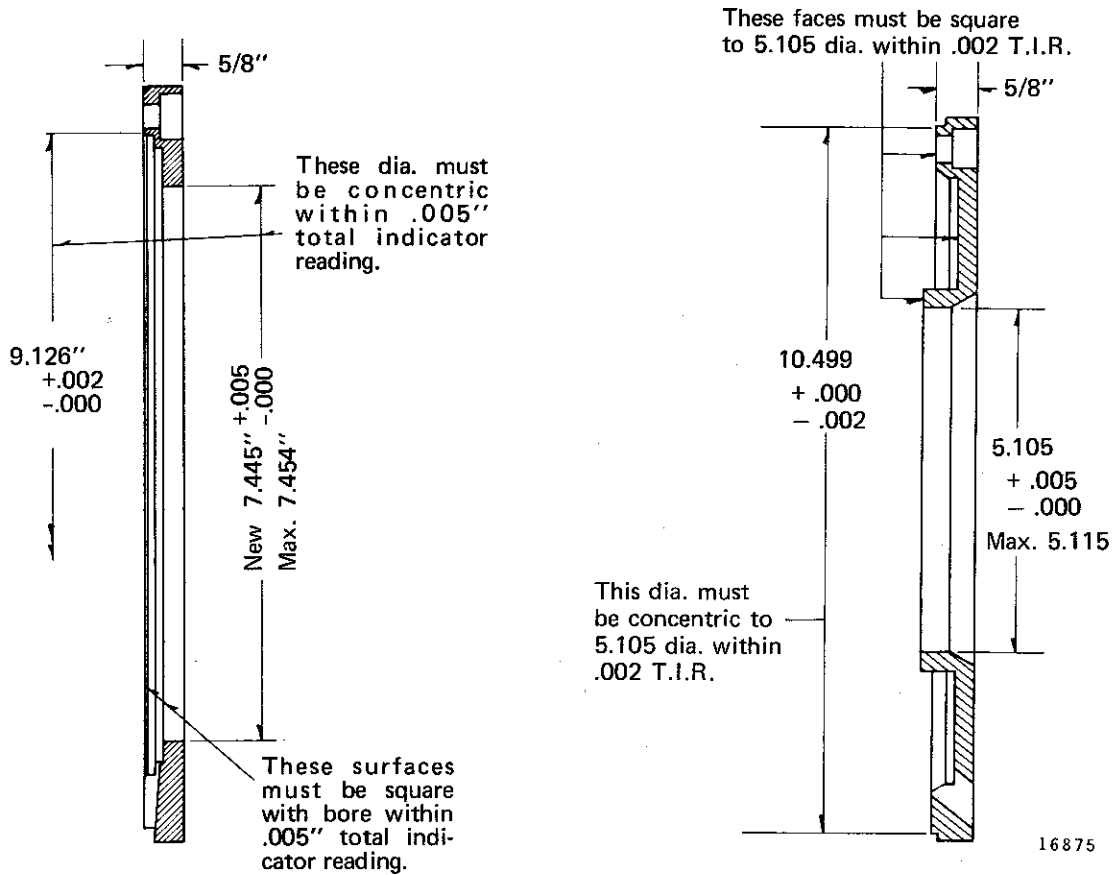
Fig. 9 — P.E. Grease Seal

3. All other dimensions should not vary more than .002" for seals that have been in service, see Figs. 9 and 10.



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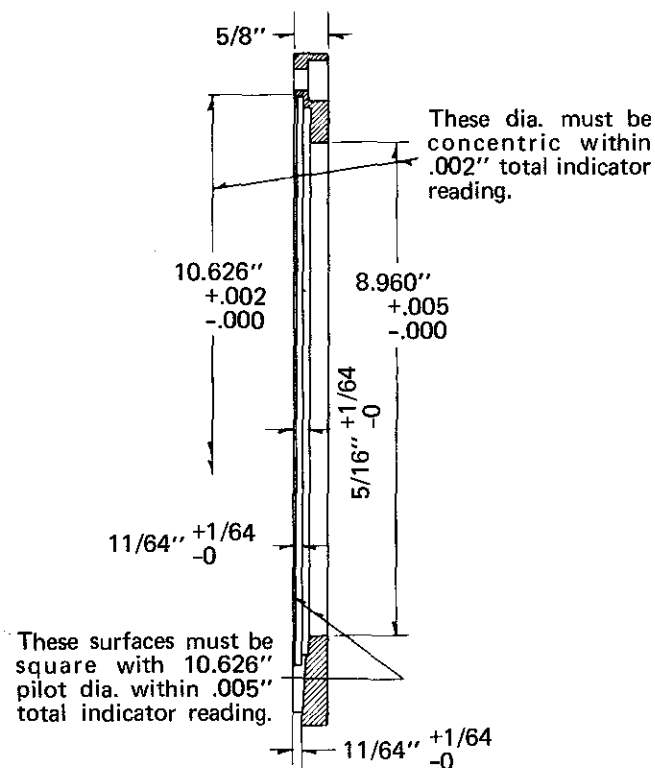
Fig. 8 — P.E. Bearing Cover "E" Model



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Fig. 9 — P.E. Grease Seal



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Fig. 10 — P.E. Grease Seal "E" Model

PINION END INNER OIL RING

1. Check the bore diameter. Condemning limit is 5.189". On "E" model rings the limit is 6.7205".
2. Check the O.D. of the inner oil ring. Minimum diameter is 7.336". On "E" models the minimum diameter is 8.853".
3. Face and bottom of the groove must be perpendicular to the bore within .006" total indicator reading. The two outside faces must be perpendicular to the bore within .001".
4. Check the ring for distortion, rubbing and wear on the outside diameter and also in the face groove. When wear or rubbing is found, the ring should not be used.

PINION END INNER OIL THROWER

1. Check the oil thrower bore diameter. Condemning limit is 5.189". On "E" models the condemning limit is 6.7205".
2. Check thrower outside diameter for rubbing, wear and distortion. When found to be worn or distorted, the thrower should not be used.
3. The two outside faces must be perpendicular to the bore within .001" total runout. The outside diameter must be concentric with bore within .006" total indicator reading. The lip faces must be perpendicular to bore within .006" total runout.
4. If flange of oil thrower is damaged, do not use.

PINION END OUTER OIL THROWER

1. Check the bore diameter. Condemning limit is 5.0955". On "E" models the limit is 6.691".

All other inspection referring to warpage, squareness, and concentricity shall be the same as for pinion end inner oil thrower.

PINION END OUTER GREASE SLINGER

The P.E. outer grease slinger, Fig. 11, is used only in the current D77 seal arrangement.

Check the bore diameter as well as the other dimensions shown in Fig. 11 for evidence of rubbing, wear, and distortion. When found to be worn or distorted, the slinger should not be used.

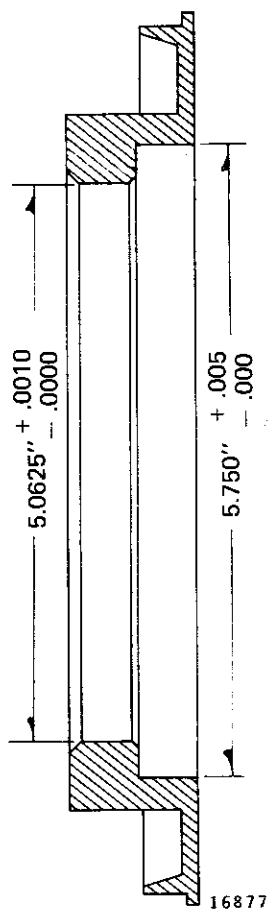
PINION END OUTER OIL RING

The dimensions must be held within .002" of drawing tolerance, Figs. 12 and 13, with the exception of the bore which must be held to drawing tolerance shown.

PINION END BEARING HOUSING

1. Check the bearing housing bore, Fig. 14. Condemning limit is 11.0234". On "E" models it is 12.5986".
2. Check the bearing housing to frame pilot diameter. Condemning limits for this diameter are as follows: Standard housing pilot diameter limit is 22.879" ± .001". Service tolerance on oversize bearing housing pilot diameters are shown below.

Housing Pilot Dia.	Limit
1/32"	22.907"
3/32"	22.972"
1/16"	22.942"
1/8"	23.002"



(D77B Motors Built Since 1/71)
Fig. 11 — P.E. Outer Grease Slinger

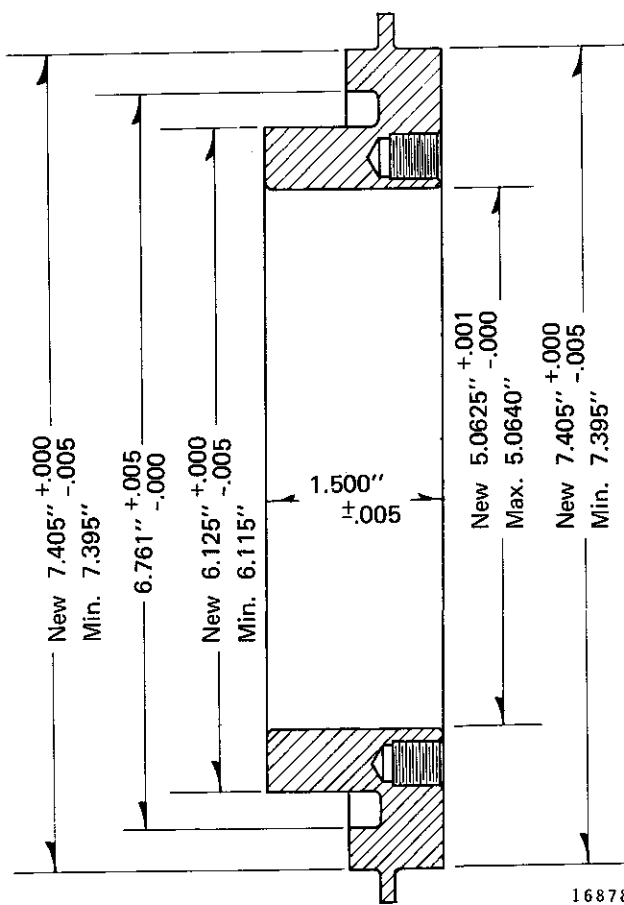


Fig. 12 — P.E. Outer Oil Ring

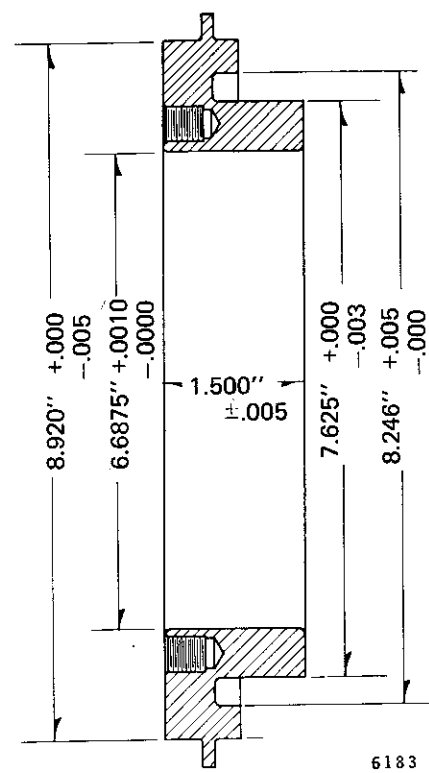


Fig. 13 — P.E. Outer Oil Ring "E" Model

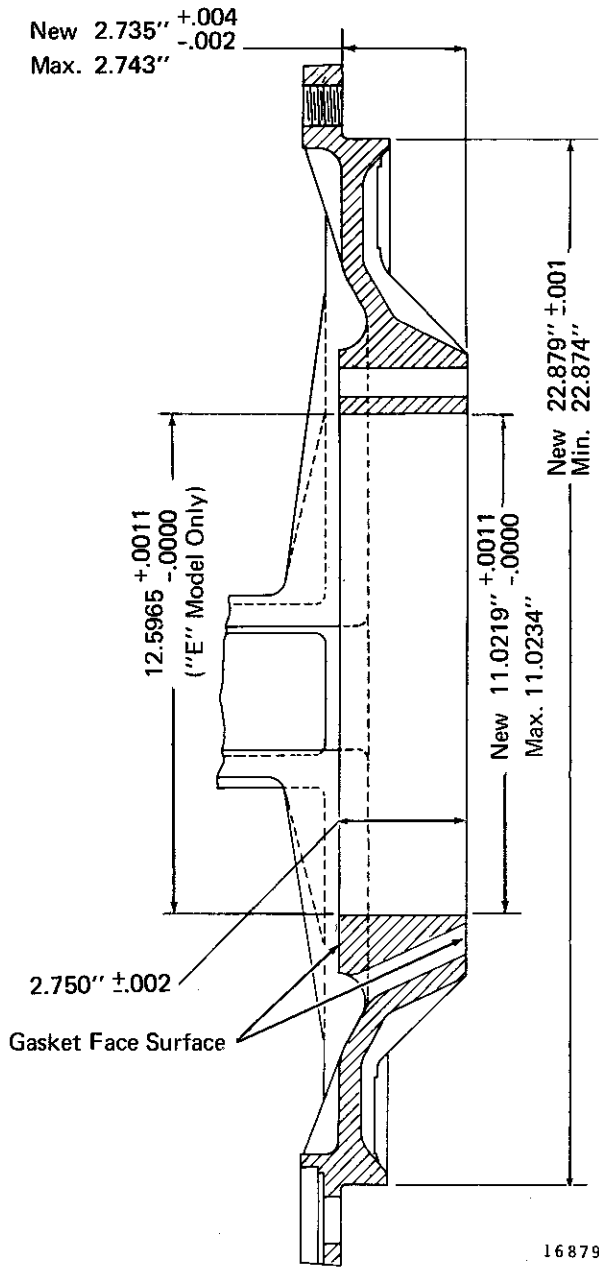


Fig. 14 - P.E. Bearing Housing

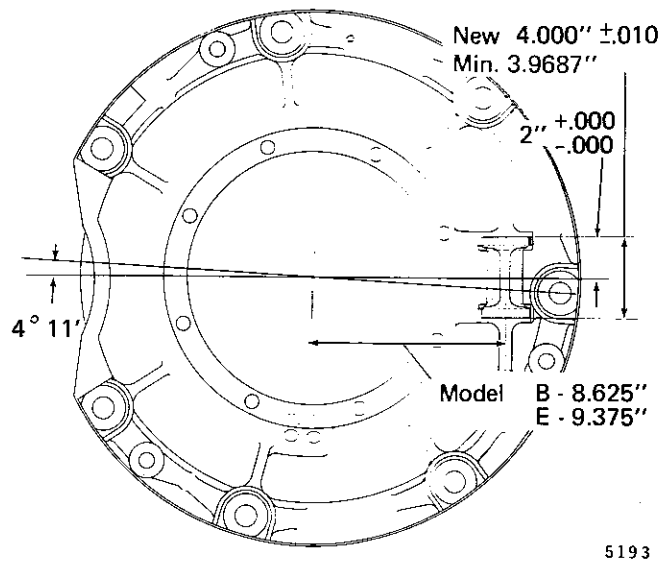


Fig. 15 - Front View Of P.E. Housing

3. Inspect the housing for warping or distortion. The frame mounting surface to the inside bearing bore face shall not exceed 2.743", except an area of 2" on either side of the three jackout bolt holes which may be pulled out up to 1/64". If distorted more than this, the housing should not be used.
4. Check the dimension between upper and lower faces, Fig. 15, of the gear case support arm. Condemning limit is 3.9687". When this dimension is below the condemning limit, the surface may be built up with weld by depositing one bead around the 1-1/16" diameter hole starting at the open end of arm and parallel to the long side. Deposit beads to the required height to the remainder of the surface to be built up.

5. After welding, machine arm to $4'' \pm .010''$ holding location dimension of part being repaired as shown in Fig. 15.

6. Paint inside of housing with red enamel 8061130.

ARMATURE ROLLER BEARINGS

CLEANING

Upon disassembly of the traction motor, the armature bearings should have been kept together as an assembly and protected from dirt or damage by wrapping in clean noncorrosive paper. After unwrapping for cleaning and inspection, every care should be taken to keep the bearings clean and to handle them carefully.

Bearings may be washed using clean Stoddards solvent (ASTM D474-40) or some similar noncorrosive solvent with flash point of 115° F. or higher. Apply solvent with a brush or rag, being careful that bristles and threads do not come loose in bearing. Cotton waste should never be used. A tank with a small motor driven pump with hose and nozzle connection will be found advantageous in reaching inaccessible spots in the bearing.

INSPECTION PROCEDURE

Roller bearing assemblies should be carefully inspected with the aid of adequate light and a magnifying glass of two (2X) power to prevent eye strain. Bearings should be handled with clean hands adequately protected by lanolin to prevent staining and corrosion.

In order to keep the details of each inspection as clear and concise as possible, a glossary of terms follows.

GLOSSARY OF TERMS

Cracks — Separations of the bearing material resulting in jagged dark lines or chasms, cause by material defects, severe mishandling, overheating, overstressing or fatiguing.

Craters — Small deformities in the normal surface with ragged edges, molten, discolored, bright bottoms and a contrasting edge. They are formed by the passage of electrical currents through the bearing and are dangerous when the area is large enough to increase the unit load, or when the depth indicates a large electrical discharge and subsequent tempering of the bearing metal.

Dents — Shallow deformations in the normal surface. They are caused by smoothedged particles being forced or rolled into the surface. If severe they may rupture the surface, cause a protrusion, or if large, act as a flat.

Flaking — Small areas of the normal surface where the steel has been freed, revealing a "fish scale" appearance. Flaking is usually the next stage after pitting (but sometimes is the first apparent indication of fatigue) which has developed from a pit formed since the last inspection.

Flats — Sections of the normal surface with bright bottoms which have been reduced from the original diameter. They can be caused by grinding, severe denting due to handling, skidding of a roller when held in the loaded area, by faulty reduction of a protrusion, and by severe denting from static load (brinnelling). Flats cause the bearing parts to be stressed abnormally.

Galling — Transfer of metal from one part onto another. This is caused by relative motion under extremely high pressures without lubrication, generally accompanied by heating.

Nicks — Sharp-bottomed deformations in normal surface of some depth, but relatively little width. They are caused by a sharp edge being forced into the surface. If severe, they may rupture the surface or cause a protrusion.

Operating Surfaces — The areas of the rollers and races which contact with each other under load.

Pits — Small holes in the normal surface with ragged edges and dark bottoms. They are caused by extended corrosion, fatigue cracking, and minute flaking. Those due to fatiguing will generally be accompanied by indentation or imprinting of the material freed from the surface and then rolled between the rollers and races. Those due to corrosion will be localized to sections originally stained or etched. It can be seen that fatigue pits are the initial signal of failure and the end of useful life, and therefore demand scrapping of the parts involved. Corrosion pits, if isolated and arrested in growth, are dangerous only in that they reduce the contact area and increase the unit load, thereby increasing the rate at which the part is fatiguing.

Protrusions — Metal displaced above normal surface. On operating surfaces, this results in stress concentrations at protrusions and hastens fatigue. They are found around some dents, nicks, scratches, scores and craters.

Roller Path — That section of the race which the rollers contacted in service. This can be detected from the normal surface by the wearing of the original grinding nap.

Ruptures — Separations of the normal surface generally leaving sharp corners, jagged edges, or cracked sections at their bottoms. They are found in some dents, scratches, nicks, and scores. Ruptures are the focal points for fatigue stresses and so can be the origin of the cracks, pits, flaking, spalling and the ultimate failure.

Scores — Axial deformations of heavy character with rough or torn bottom. They are caused by gouging a bearing surface while forcing a roller over a race under load and while slightly cocked.

Scratches — Deformations of the normal surface with bright bottoms caused by forcing hard sharp objects over the surface in long, narrow, sharp-bottomed gouges. Scratches are generally of little danger so long as they have no protruding edges, do not rupture the normal surface, and do not constitute a flat.

Seams — Inclusions of foreign material in the bearing metal which are exposed on the normal surface. They are harmful only when too large or numerous.

Shelling — Areas on the normal surface where the material has broken loose, leaving jagged edges with a rough "washboard" bottom which is sometimes bright. This is caused by advanced fatiguing beyond the pitting stage, in which large sections of the surface are freed by extensive subsurface cracking.

GENERAL

On all bearings which have seen appreciable service, some dents, nicks, pits and craters will be found. If these are small and scattered they should not cause rejection, however, they must be evaluated with good judgment and with reference to the overall condition of the bearing. Remember that all questions of doubt should be settled on the safe side.

In general, scrapped parts may be replaced with new ones. It must be remembered that if one part of an assembly was under any extended or excessive stressing which resulted in a visible defect severe enough to scrap it, then the rest of the assembly requires a cautious and detailed inspection and evaluation before use.

CAUTION: Traction motors built since January 1, 1971 are equipped with an offset crown inner race type bearing at the pinion end. When replacing bearing parts, be careful not to mix component parts. See Section 3 of this Maintenance Instruction "Assembly And Test" for additional information.

The inspection procedure is divided into four parts as follows: (1) Operating Surfaces, (2) Nonoperating Surfaces, (3) Cages, and (4) Dimensional.

OPERATING SURFACES

All exposed operating surfaces must be inspected visually to ensure that they contain none of the following defects which will be cause for rejection:

1. Protrusions above the normal surface.

NOTE: Protrusions may be reduced to the normal surface by light circumferential honing with Arkansas stone or grade 240 cloth. Likewise, the sharp edges may be smoothed. Care must be taken to work down to the normal surface only, to prevent reduction of contact area, and to work circumferentially so as to prevent the formation of flats.

2. Cracks and flats.
3. Ruptures, tears or seams (3/32" or more in length, or more than hairline width).
4. Scores or deep scratches which extend more than 3/4 the length of the operating surface and are inclined at less than 10° to the axis.
5. Corrosion pits (1/32" or more in diameter).
6. Craters or pits from electrical arcing (1/32" or more in diameter).
7. Profuse denting or cratering.
8. Overheating.
9. Circumferential pattern of pits or dents at the ends of the roller path.
10. Fatigue pits, flaking, shelling or galling.

NONOPERATING SURFACES

All nonoperating surfaces are to be visually inspected for:

Rust — Remove by rubbing with a grade 240 abrasive cloth. If rust pits of great depth are encountered they must be cleaned.

Galling — Smooth down by rubbing with a grade 240 abrasive cloth. Care must be taken not to reduce the normal surface. (See Dimensional).

Cracks — Reject bearing.

Severe Physical Abuse — Evaluate to determine whether it is heavy enough to affect the operating surfaces. In addition, each such location must be reduced by light honing with an Arkansas stone.

Overheating — Reject bearing.

CAGES

Cages must be inspected to ensure that they are free from cracks and burrs and have no loose or missing rivets.

DIMENSIONAL

Bearing parts must be checked dimensionally so as to maintain the proper fits and to determine the change in internal clearance due to wear.

The following tolerances must be held on the diameters of the races:

Pinion End Bearing

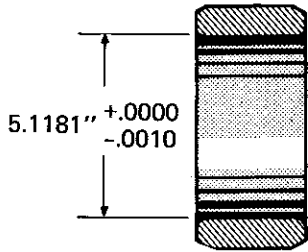
Inner race inside diameter 5.1171" to 5.1181". See Fig. 16 ("E" model is 6.6919" to 6.6929").

Outer race outside diameter 11.0229" to 11.0236". See Fig. 17 ("E" model is 12.5974" to 12.5984").

Commutator Eng Bearing

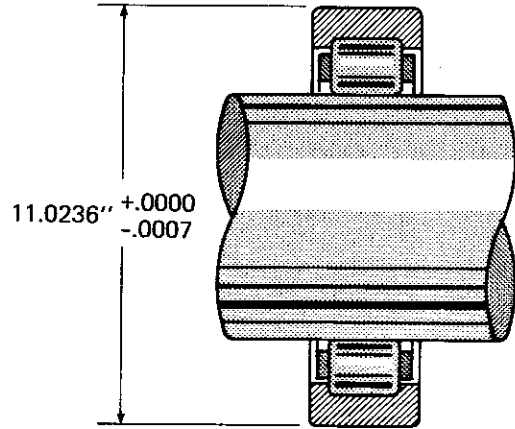
Inner race inside diameter 3.9362" to 3.9370". See Fig. 18.

Outer race outside diameter 8.4639" to 8.4646". See Fig. 19.



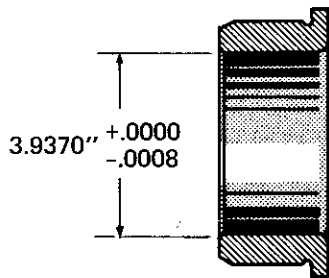
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Fig. 16 — P.E. Inner Race



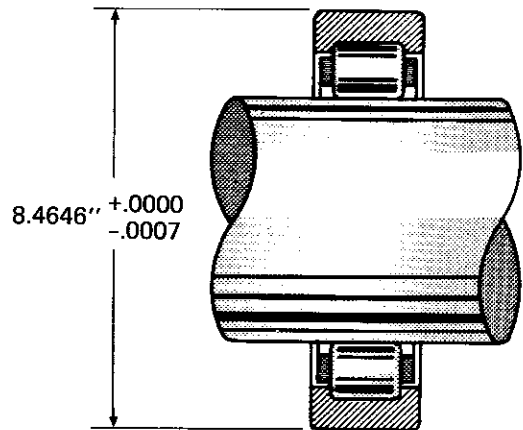
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Fig. 17 — P.E. Outer Race And Roller



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Fig. 18 — C.E. Inner Race



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Fig. 19 — C.E. Outer Race And Roller

Pinion end inner races must be measured to assure that no race, with a roller path diameter deviating .001" or more from the normal unworn surface, will be used. Races with such a deviation are to be scrapped because of the possibility of being assembled so that the rollers will run on the ridge rather than on the worn circumference.

The internal radial clearance is checked by hanging the assembled bearing by its inner race and passing a feeler gauge between each roller and race on the unloaded side for limits to be maintained. Clearance between race and rollers of bearings not installed in motors is as follows:

Pinion end bearing — .0064" to .0082" ("E" model is .0078" to .0096").

Commutator end — .0055" to .0073".